UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/733,141	12/11/2003	Veera Palanivelu Rajendran	133428	7377

7590 05/19/2005

General Electric Company (PCPI)
c/o Fletcher Yoder
P.O. Box 692289
Houston, TX 77269-2289

EXAMINER	
JAGAN, MIRELLYS	

ART UNIT	PAPER NUMBER
2859	

DATE MAILED: 05/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/733,141	RAJENDRAN ET AL.
	Examiner	Art Unit
	Mirellys Jagan	2859

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 2/28/05

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-25 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-25 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-4, 6, and 8-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,636,041 to Arz et al [hereinafter Arz] in view of U.S. Patent 4,827,487 to Twerdochlib.

Arz discloses a method for monitoring deformations in at least one location of an electromagnetic coil assembly 21, as shown in Fig. 2, the electromagnetic coil assembly having at least one electrical winding, the method including the steps of:

passing a light through a non-magnetic optical fiber LF10 wound and cast with the electrical winding, the optical fiber LF10 having a core containing at least a first Bragg grating BG11 etched therein;

detecting a wavelength of light reflected from the first Bragg grating BG11;

determining a deformation of the electromagnetic coil assembly at a location of the first Bragg grating BG11 utilizing the detected wavelength of the light reflected from the first Bragg grating BG11;

detecting a wavelength of light reflected from at least a second Bragg grating BG12 at a location spaced apart from the location of the first Bragg grating BG11;

determining a deformation of the electromagnetic coil assembly 21 at least at a location of the second Bragg grating BG12 utilizing the detected wavelength of the light of the reflected from the second Bragg grating BG12;

distinguishing reflected light from the at least a second Bragg grating BG12 from reflected light from the first Bragg grating BGll (see column 5, lines 30-40); and

passing a current through an electrical winding of the electromagnetic coil assembly 21(see column 4, lines 3-6);

wherein said passing a light through an optical fiber LF10 comprises passing light from a laser 54 through the optical fiber LF10; the core of the optical fiber LF10 has a plurality of Bragg gratings BGl1, BG12 etched therein at different lengths along the fiber LF10; the Bragg gratings BGII, BG12 in the wound optical fiber LF10 are disposed at different locations in the electromagnetic coil assembly 21; passing a light through an optical fiber LF10 comprises passing light from a variable frequency laser 54 through the optical fiber LF10; light reflected from a plurality of Bragg gratings BG11, BG12 is used to monitor deformations at a plurality of locations in the electromagnetic coil assembly 21; light reflected from the different gratings are distinguished from light reflected from a first grating using optical reflectometry; the electromagnetic coil assembly 21 is in an electric machine (see figure l); and the electromagnetic coil assembly 21 is in a magnetic resonance imaging system.

Arz further discloses in his description of the Prior Art that fiber Bragg gratings can be used as a sensor for acquiring temperature changes, since the Bragg gratings depend on temperature, which leads to a modification of grid spacings of the Bragg gating and thus to a characteristic change of the wavelength of the light reflected by the Bragg grating; and that

temperature sensors can be provided in the windings to monitor the temperature thereof (see column 2, lines 32-41).

Arz does not disclose determining a temperature of the electromagnetic coil assembly at a location of the Bragg gratings; the fibers being inserted in a non-magnetic sheath; cooling the electromagnetic coil assembly in accordance with the determined temperatures; and using OTDR as the reflectometry technique.

Twerdochlib discloses monitoring and cooling the temperature of a coil assembly having electrical windings by using a non-magnetic fiber optic inserted in a non-magnetic sheath that is cast and wound with the winding to measure temperatures. The fiber is inserted into the hollow sheath so that it not directly bonded to the coil so that it is not exposed to thermally induced strains that can alter the temperature measurement characteristics of the fiber. Twerdochlib teaches that it its desirable to measure the temperature of the windings using reflectometry techniques such as OTDR (see column 2, lines 7-15; column 3, lines 27-39; column 4, lines 18-29; and column 7, lines 30-50).

Referring to claim 1, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the method disclosed by Arz by replacing the temperature sensor with optic fibers in a non-magnetic sheath, as taught by Twerdochlib, in order to monitor temperature changes throughout the windings and control the temperature of the windings. Furthermore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to use fibers with gratings and a reflectometery technique, as disclosed by Arz, to obtain the temperature measurements since his processor is configured to

receive and utilize reflectometery using optic fibers with Bragg gratings that can be used as sensors for acquiring temperature changes.

Referring to claim 6, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the method disclosed by Arz and Twerdochlib by using OTDR as a reflectometery technique to obtain the temperature measurements from the sheathed fibers, as taught by Twerdochlib, since Twerdochlib teaches that OTDR is a useful technique for measuring temperatures using optic fibers, and since Arz's processor is configured to receive and utilize a reflectometery techniques using optic fibers with Bragg gratings that can be used as a sensor for acquiring temperature changes.

4, Claims 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arz and Twerdochlib, as applied to claims 1-4, 6, and 8-12 above, and further in view of U.S. Patent 6,547,435 to Grosswig et al [hereinafter Grosswig].

Arz and Twerdochlib disclose a method having all of the limitations of claims 5-7, as stated above in paragraph 3, except for the particular reflectometery technique being an intensity-based reflectometery technique such as OFDR or OFTR.

Grosswig teaches the used of intensity based reflectometry such as optical frequency domain reflectometry and optical time domain reflectometry in order to measure locally resolved detection of temperature measurements (see column 1 lines 55-67).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the method of Arz and Twerdochlib by using intensity based reflectometry such as optical frequency domain reflectometry and optical time domain

reflectometry as the reflectometery technique, as taught by Grosswig, in order to measure locally resolved detection of temperature measurements by distinguishing reflected light from the at least a second Bragg gating from reflected light from the first Bragg grating, and since Arz's processor is configured to receive and utilize a reflectometery techniques using optic fibers with Bragg gratings that can be used as a sensor for acquiring temperature changes.

5. Claims 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arz in view of Twerdochlib.

Arz discloses an electromagnetic coil assembly kit having:

an electrically conducting electromagnetic winding;

a non-magnetic fiber optic fiber LF10 wound and cast therein and having distributed therein a plurality of Bragg gratings BGl1, BG12, each configured to reflect light indicative of deformation at a location of the Bragg gratings in the electromagnetic coil assembly 21;

an electric machine including the electromagnetic coil assembly kit, as shown in Fig. 1; and a magnetic resonance imaging apparatus having the electromagnetic coil assembly kit, wherein said electromagnetic winding is configured as a gradient coil.

Arz further discloses in his description of the Prior Art that fiber Bragg gratings can be used as a sensor for acquiring temperature changes, since the Bragg gratings depend on temperature, which leads to a modification of grid spacings of the Bragg gating and thus to a characteristic change of the wavelength of the light reflected by the Bragg grating; and that temperature sensors can be provided in the windings to monitor the temperature thereof (see column 2, lines 32-41).

Arz does not disclose a non-magnetic sheath wound and cast in the winding and having an optic fiber inserted in the sheath configured to indicate the temperature of the winding.

Twerdochlib discloses monitoring and cooling the temperature of a coil assembly having electrical windings by using a non-magnetic fiber optic inserted in a non-magnetic sheath that is cast and wound with the winding to measure temperatures. The fiber is inserted into the hollow sheath so that it not directly bonded to the coil so that it is not exposed to thermally induced strains that can alter the temperature measurement characteristics of the fiber. The system of Twerdochlib provides additional coolant or ventilation when a determined temperature exceeds a limit. Twerdochlib teaches that it its desirable to measure the temperature of the windings using reflectometry techniques such as OTDR (see column 2, lines 7-15; column 3, lines 27-39; column 4, lines 18-29; and column 7, lines 30-50).

Referring to claim 13, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the kit disclosed by Arz by replacing the temperature sensor with optic fibers in a non-magnetic sheath, as taught by Twerdochlib, in order to monitor temperature changes throughout the windings and control the temperature of the windings. Furthermore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to use fibers with gratings and a reflectometery technique as disclosed by Arz, to obtain the temperature measurements since Arz's kit is configured to receive and utilize reflectometery using optic fibers with Bragg gratings that are known to be used as sensors for acquiring temperature changes.

6. Claims 17-19 and 23-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Arz in view of Twerdochlib.

Arz discloses a measuring apparatus having;

an electromagnetic coil assembly 21 having an electrically conducting electromagnetic winding; and

a non-magnetic fiber optic fiber LF10 in communication with the electromagnetic winding, said fiber optic fiber LF10 having distributed therein a plurality of Bragg gratings BGl1, BG12, each configured to reflect light indicative of a deformation at a location thereof;

a light source configured to pass light into the fiber optic fiber LF10;

a reflected light sensor 53 configured to sense light reflected back from the Bragg gratings BGl1, BG12;

a processor 51 responsive to the reflected light to determine deformations utilizing said reflected light;

wherein said light source is a laser 54; the laser 54 is a 'variable frequency laser; and the electromagnetic winding is configure as a gradient coil.

Arz further discloses in his description of the Prior Art that fiber Bragg gratings can be used as a sensor for acquiring temperature changes, since the Bragg gratings depend on temperature, which leads to a modification of grid spacings of the Bragg gating and thus to a characteristic change of the wavelength of the light reflected by the Bragg grating; and that temperature sensors can be provided in the windings to monitor the temperature thereof (see column 2, lines 32-41).

Arz does not disclose a non-magnetic sheath wound and cast with the windings and having an optic fiber inserted in the sheath; and the processor determining temperature using

light reflected from the sheathed fibers and configured to at least one of turn off current through the electromagnetic winding, or provide additional coolant or ventilation when a determined temperature exceed a limit.

Twerdochlib discloses monitoring and cooling the temperature of a coil assembly having electrical windings by using a non-magnetic fiber optic inserted in a non-magnetic sheath that is cast and wound with the winding to measure temperatures, wherein the system of Twerdochlib provides additional coolant or ventilation when a determined temperature exceeds a limit. The fiber is inserted into the hollow sheath so that it not directly bonded to the coil so that it is not exposed to thermally induced strains that can alter the temperature measurement characteristics of the fiber. Twerdochlib teaches that it its desirable to measure the temperature of the windings using reflectometry techniques such as OTDR (see column 2, lines 7-15; column 3, lines 27-39; column 4, lines 18-29; and column 7, lines 30-50).

Referring to claim 17, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the apparatus disclosed by Arz by replacing the temperature sensor with optic fibers in a non-magnetic sheath, as taught by Twerdochlib, in order to monitor temperature changes throughout the windings and control the temperature of the windings. Furthermore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to use fibers with gratings and a reflectometery technique as taught by Arz, to obtain the temperature measurements since Arz's kit is configured to receive and utilize reflectometery using optic fibers with Bragg gratings that are known to be used as sensors for acquiring temperature changes.

7. Claims 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arz and Twerdochlib, as applied to claims 17-19 and 23-25 above, and further in view of Grosswig.

Arz and Twerdochlib disclose an apparatus having all of the limitations of claims 20-22, as stated above in paragraph 6, except for the particular reflectometery technique being an intensity-based reflectometery technique such as OFDR or OFTR.

Grosswig teaches the used of intensity based reflectometry such as optical frequency domain reflectometry and optical time domain reflectometry in order to measure locally resolved detection of temperature measurements (see column 1 lines 55-67).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the method of Arz and Twerdochlib by using intensity based reflectometry such as optical frequency domain reflectometry and optical time domain reflectometry as the reflectometery technique, as taught by Grosswig, in order to measure locally resolved detection of temperature measurements by distinguishing reflected light from the at least a second Bragg gating from reflected light from the first Bragg grating, and since Arz's processor is configured to receive and utilize a reflectometery techniques using optic fibers with Bragg gratings that are known to be used as a sensor for acquiring temperature changes.

Response to Arguments

8. Applicant's arguments with respect to claims 1-25 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following patents and publications disclose optic temperature measuring techniques:

U.S. Patent Application Publication 2005/0013342 to Kaminski et al
U.S. Patent 6,640,647 to Hong et al
U.S. Patent 6,513,972 to Jenkins
U.S. Patent Application Publication 2001/0022804 to Helmig et al
U.S. Patent 6,659,640 to Ruffa
U.S. Patent 4,298,794 to Snitzer et al
U.S. Patent 5,306,088 to Zoerner
U.S. Patent 6,079,875 to Klass et al
U.S. Patent 6,587,188 to Gleine et al
U.S. Patent Application Publication 2003/0156777 to Bosselmann et al

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mirellys Jagan whose telephone number is 571-272-2247. The examiner can normally be reached on Monday-Friday from 11AM to 5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez can be reached on 571-272-2245. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CHRISTOPHER W. FULTON
PRIMARY EXAMINER

MJ
May 12, 2005